

Ecologic Analysis of some Immune-Related Disorders, including Type 1 Diabetes, in Australia: Latitude, Regional Ultraviolet Radiation and Disease Prevalence

**Judith A Staples, Anne-Louise Ponsonby, Lynette L-Y Lim,
and Anthony J McMichael**

doi:10.1289/ehp.5941 (available at <http://dx.doi.org/>)

Online 19 December 2002



**Ecologic Analysis of some Immune-Related Disorders, including Type 1 Diabetes, in
Australia: Latitude, Regional Ultraviolet Radiation and Disease Prevalence.**

Judith A Staples, Anne-Louise Ponsonby, Lynette L-Y Lim, and Anthony J McMichael

National Center for Epidemiology and Population Health, The Australian National University,
Canberra, ACT, Australia

Address correspondence to: JA Staples, National Center for Epidemiology and Population
Health, The Australian National University, Canberra ACT 0200, Australia.

Telephone: 61 2 6125 8088. Fax: 61 2 6125 5614. E-mail: Judy.Staples@anu.edu.au

(Word Count: 5938)

Running title: Latitude, UVR and immune disorders

Key words: latitude, ultraviolet radiation, immune disorders, autoimmune disease, Type 1 diabetes, rheumatoid arthritis, asthma, eczema/dermatitis, ecologic analysis, Australia

Acknowledgments: The authors thank Dr Lilia Lemus-Deschamps, Bureau of Meteorology Research Center, Australia, for provision of regional monthly UVR data.

The research was supported by an Australian National University (ANU) Graduate School scholarship and a supplementary scholarship from the National Center for Epidemiology and Population Health, ANU, awarded to JA Staples.

Abbreviations:

ABS	Australian Bureau of Statistics	RA	rheumatoid arthritis
ACT	Australian Capital Territory	RR	rate ratio
CI	confidence interval	SA	South Australia
IL	interleukin	SE	standard error
mW/m ²	milliWatts per square meter	TAS	Tasmania
NHS	National Health Survey	Th1, Th2	T-helper 1, 2 T cells
NSW	New South Wales	UVA, UVB	Ultraviolet A, B
NT	Northern Territory	UVR	Ultraviolet Radiation
p	probability value	VIC	Victoria
QLD	Queensland	WA	Western Australia
r	correlation coefficient (Pearson)		

Section Headers:

Abstract

Introduction

Methods

Prevalence Data Source

Latitude and UVR

Statistical Analysis

Results

Latitude and Immune Disorders

Sensitivity Analysis

UVR and Immune Disorders

Discussion

References

Table 1

Table 2

Table 3

Figure Legends

Figure 1

Figure 2

Abstract

The apparent immune suppressive effect of ultraviolet radiation (UVR) has suggested that this environmental exposure may influence the development of immune-related disorders. Self-reported prevalence rates of Type 1 diabetes mellitus, rheumatoid arthritis (RA), eczema/dermatitis and asthma, from the 1995 Australian National Health Survey, were therefore examined by latitude and ambient level of UVR.

A positive association of Type 1 diabetes mellitus prevalence was found with both increasing southern latitude of residence ($r = 0.77$; $p = 0.026$) and decreasing regional annual ambient UVR ($r = -0.80$; $p = 0.018$); a 3-fold increase in prevalence from the northernmost region to the southernmost region was evident. In contrast, asthma correlated negatively with latitude ($r = -0.72$; $p = 0.046$), although the change in asthma prevalence from the north to the south of Australia was only 0.7-fold. For both RA and eczema/dermatitis there were no statistically significant associations between latitude/UVR and disease prevalence.

These ecological data provide some support for a previously proposed beneficial effect of UVR on Th1-mediated autoimmune disorders such as Type 1 diabetes. The inverse association of Type 1 diabetes prevalence with UVR is consistent with that previously reported for another autoimmune disease, multiple sclerosis (MS), in Australia, and also with Type 1 diabetes latitudinal gradients in the Northern Hemisphere. The finding also accords with photoimmunological evidence of UVR-induced immunosuppression, and may suggest a beneficial effect of UVR in reducing the incidence of such autoimmune conditions. In light of this study, analytic epidemiologic studies, investigating risk of immune disorders in relation to personal UVR exposure in humans, are required.